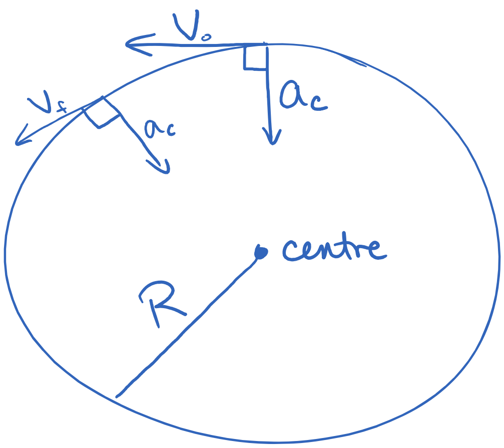
4.1 Circular Motion

November 6, 2017 12:29 PM

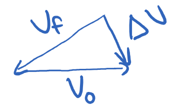
Uniform circular motion (horizontal)

centripetal acceleration - name given to any acceleration causing an object to move in a circle

- centre-seeking



$$a_c = \frac{\Delta V}{t} = \frac{V_f - V_o}{t} = \frac{V_f + -V_o}{t}$$



← centre-seeking

$\perp$ ← V along a tangent
← a_c or F_c always centre-seeking

V and a_c are perpendicular

$$a_c = \frac{V^2}{R}$$

$$V = \frac{d}{t} = \frac{2\pi R}{T}$$

T = period, once around

$$a_c = \frac{V^2}{R} = \frac{\left(\frac{2\pi R}{T}\right)^2}{R} = \frac{4\pi^2 R^{\cancel{2}}}{T^2 \cancel{R}} = \frac{4\pi^2 R}{T^2} = a_c$$

Practice "a_c" pg 124 #1-3

Ans: 1. $2.72 \times 10^{-3}\ m/s^2$ 2. $1.0\ \frac{m}{s^2}$ 3. $18.2\ \frac{m}{s^2}$

$$F = ma = \frac{mv^2}{} = m\,4\pi R$$

$$F_c = ma_c = \frac{mv^2}{R} = m\frac{4\pi^2 R}{T^2}$$

Centripetal force can be:

→ F_f - car on a curve situation $(F_c = F_f)$

→ F_g - orbital situation $(F_c = F_g)$

→ F_E - case of an e^- orbiting a proton $(F_c = F_E)$

Centrifugal Force - centre-fleeing force
- a fictional force, an apparent force caused by the inertia of an object wanting to keep going in a straight line
- in reality it is the ⊥ velocity that continues once F_c is removed

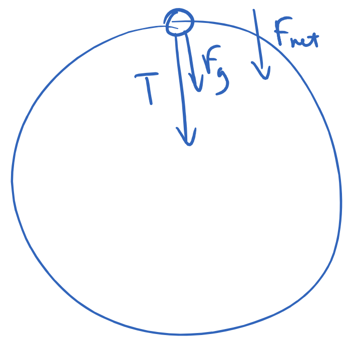
Practice pg 125 #1-3

Vertical Circular Motion (not uniform)

Centripetal Force is the net force acting toward the centre

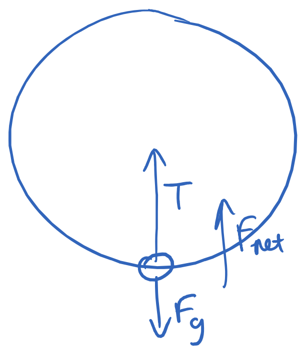
$F_{net} = F_c = T + F_g$ = net force toward

Top



$$F_{net} = \underbrace{F_c = T + F_g}$$ = net force toward centre

Bottom



$$F_{net} = \underbrace{F_c = T - F_g}$$ = net force toward centre

Note (for questions):

→ T can be the tension in string

→ if at top and "not falling" then

$$F_g = F_c \quad \text{and} \quad T = 0$$

→ if at bottom, T = "apparent weight"

$\boxed{\text{Practice pg 129 \#1–6}}$